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On THECOSPONDYLUS HORNERI, a new DINOSAUR from the HASTINGS SAND, indicated by the SACRUM and the NEURAL CANAL of the SACRAL REGION. By Prof. H. G. SEELEY, F.R.S., F.G.S. &c.

[PLATE XIX.]

DR. A. C. HORNER, of Tonbridge, has obtained from the quarry at Southborough in the Hastings Sand, and intrusted to me, what I believe to be a unique specimen, so far as this country is concerned, exhibiting a mould of the entire neural cavity of the sacral region of a Dinosaur. But the specimen is nevertheless peculiarly tantalizing, since the quarryman states that it is the only specimen of any kind that he has ever found in the quarry, and enough remains of bony tissue upon the cast to render it certain that the external mould of the sacrum, if not the bony tissue itself, might have been preserved. It is imperfect both anteriorly and posteriorly, but measures exactly 60 centimetres in length. The vertebræ which are complete are five in number; each is 11 centim. long; but there is a small fragment in front which appears to show that there was another vertebra anteriorly (fig. 2, 1), while the fragment of the posterior vertebra (fig. 2, 7) admits of no question. We have thus a sacrum which certainly included six or seven vertebræ, and may have comprised more. The bony tissue is preserved only upon the right side of three consecutive vertebræ. It is a thin film closely adherent to the cast, showing a cancellous structure external to the thin interior layer (fig. 1, b). This film is not more than from 1 to 2 millim. in thickness, and therefore gives no clue to the form of the sacrum; though other evidence leads me to believe that the bone was extremely thin, and pertained to an animal closely allied to *Ornithopsis*.

The neural chamber of this sacrum, besides being remarkable for its great length, is singularly compressed from side to side (fig. 2), and expanded from below upward (fig. 1). It is at first sight no easy task to distinguish the back from the front. In *Anoplosaurus curtonotus* I figured the neural canal of a Dinosaur (Quart. Journ. Geol. Soc. vol. xxxv. pl. xxxiv.), which seemed to prove that the anterior third of the neural canal is the part which has the greatest transverse expansion. Subsequently Prof. Marsh (Am. Journ. Sci. vol. xxi. pl. 6, 1881) figured a cast of the neural cavity of *Stegosaurus*, in which the sacral canal is about 26 centim. long, and, where highest, 7·6 centim. high, and 4·3 centim. wide in front.

*Anoplosaurus* from the Cambridge Greensand had the sacral nerves of moderate size; but the casts of the foramina between the vertebrae, which are represented in Professor Marsh's plate, are deep and narrow, and two of them extend the entire height of the neural cavity. In regarding the larger portion of the sacrum as anterior, we follow what may be termed Dinosaurian precedents; and when we

observe on the sides of this specimen large vertical eminences (fig. 1, *t*), which resemble those figured by Prof. Marsh, we might be tempted to suppose that here too were intervertebral foramina, were it not that a large transverse process (figs. 1 & 2, *ta*) is preserved which exactly fits on to one of them. This transverse process is a cast in sandstone without a trace of bony tissue; but, from the sharpness of its contours, it assists in demonstrating the conclusion that the bony substance of this sacrum must have been of extreme thinness. The true intervertebral foramina pierced through the middle of the vertebræ, and are small transversely oval apertures with sharp clean margins (fig. 1, *v*), such as could only have been left by a thin film of bone having been removed. The junctions of the vertebræ appear to have been complete, so that no aperture existed in the sutural line of the vertebræ. The width of the cast (fig. 2) below the first foramen is 1.7 centim., below the second it is 1.6 centim., below the third it is 2 centim., below the fourth it is 1.8 centim., below the fifth it is 1.2 centim., and was evidently less in the next succeeding vertebra. These foramina lie in a straight line (fig. 2); and the cast expands below them in depth as though it sunk into the bodies of the vertebræ; but this depression is very small in amount, as is evidenced by the very gentle convexity in length of the base of the specimen; but superiorly the cast expands in a remarkable way in a convex curve, which, however, is flattened over each neural arch (fig. 2).

The anterior part of the first vertebra, of which the centrum is preserved, is broken away, so that its depth at the foramen cannot be given with certainty; it was probably about 4.5 centim. Over the second foramen (fig. 1, 3) the depth is 7.5 centim., over the third (fig. 1, 4) nearly 8.5 centim., over the fourth (fig. 1, 5) 6.7 centim., over the fifth (fig. 1, 6) 4 centim., while the next appears to be diminishing further. Thus this neural canal is distinguished from all forms hitherto known by its extraordinary lateral compression relatively to height in the middle region.

The foramina appear to be situated at about the middle of the neural canal in front, below the middle in the next three vertebræ, and above the middle in the last preserved.

The first foramen does not differ greatly in length from the others; it is under 2 centim. long, of ovate form, and 1 centim. deep. Its outlet is vertical above and oblique posteriorly. The second foramen is deeper, and opens obliquely posteriorly; the third foramen is narrower than the first, and pointed in front and behind. The fourth is large, and the fifth small and narrow. In every case except the last the neural canal is wider above the foramen than below it.

The base of the specimen is rounded from side to side with a slight longitudinal median groove behind (fig. 2), and with an expansion or swelling in the region of the sutures between the vertebræ. The rounding is most marked in the middle of each centrum; and in front there is a slight approach to flattening. The nutritive foramina (fig. 2, *n*) are well seen in the first vertebra preserved; they are narrow, 1 centim. long, 1 centim. apart, and 5 centim. from the anterior margin. In the next two vertebræ they are much smaller and less

distinctly marked; in the fourth they are smaller still, but wider apart, and still preserve the same distance from the anterior border of the vertebra. In the sixth they become large again, are less than a centimetre apart, and a little more anterior in position.

The sutural line between the vertebræ shows that in the region of the centrum the outline was convex from above downward in front laterally, and concave from side to side at the base in front. The sutures between the vertebræ are marked by sharp narrow grooves, which correspond to ridges on the interior of the bone. The suture appears to pass upward, so as to merge into the neuro-central suture, which is faint, but best marked in the last vertebra, where it passes below the lateral neural foramen. The antero-posterior limits of the neural arch correspond closely to the limits of the centrum.

The transverse processes are directed forward in front, outward in the middle, and backward behind (fig. 2). They are given off, as nearly as may be, in the line of the lateral intervertebral sutures, and just in front of the sutures on the base. There is no evidence of any separate bony base to these processes, separating them from the neural canal, though such partitions probably existed. The first of these processes on the right side is at the fracture  $4\frac{1}{2}$  centim. deep, and widens from 1 centim. above to  $2\frac{1}{2}$  centim. below. It is situate just in front of the intervertebral suture.

The attachment of the second process is 4.8 centim. deep, with its base placed a little higher than the first. Its margin is concave in front; and the concavity appears to have excavated the process much as in the first process. The third process is fractured nearer to its base, and is less than 4 centim. deep and about 2 centim. wide. The fourth is smaller; the fifth, hardly more than  $1\frac{1}{2}$  centim. deep and 1 centim. wide, diverges conspicuously backward and outward.

The first process on the right side expands outward and forward in a subconical way, so as to terminate in a large flattened facet for the ilium (fig. 1, *ta*), which is vertical in position, though inclined somewhat forward, and a little convex from above downward. It is 11.5 centim. deep and 7.5 centim. wide where widest. The posterior border is convex, and the posterior side gives off a little rounded ridge where it joins the side of the cast of the neural region. In front the outline of its articular end is more angular, being compressed below and above. A blunt ridge runs on the inner side from the middle, and expands upward so as to form the superior part of the transverse process at its base, in such a way as to give an aspect to the process of being excavated in front.

The transverse processes would give a width to the sacrum in front of 20 centim., which was probably increased towards the middle.

Behind the transverse processes there is a moderate circular inflation of the cast, which is conspicuous in all the vertebræ, so that in front of the neural foramen there is a somewhat convex rugose tubercle, as though bone were attached to it.

I cannot speak with any certainty of the affinities of the remark-



able animal thus indicated; for if my inference from the condition of the transverse process is correct, it belongs to a very different type of animal from the Dinosaurs hitherto known, which have heavy vertebræ in the sacral region. The only English genus (*Ornithopsis*) which has pneumatic vertebræ and dense bony tissue, must be assumed, from the allied American genera, to have had a sacrum of very different character. There is no proof that the vertebræ of *Thecospondylus* were pneumatic; but the bones were formed on the lightest type that I have yet seen, and indicate, I believe, an ordinal or subordinal group, in which the skeleton was not pneumatic, but as dense and light as in the Ornithosauria, and supported on powerful hind limbs.

With an enlightened liberality which deserves our thanks, Dr. Horner has commissioned me to deposit the specimen in the national collection at South Kensington, that it may be the better available for study.

#### EXPLANATION OF PLATE XIX.

- Fig. 1. Right lateral aspect of east of neural cavity of sacrum, showing:—the sequence of vertebræ, numbered 1 to 7; the bases of the transverse processes (*t*) on the 3rd, 4th, 5th, and 6th vertebræ, and the large expanded articular facet of the 2nd transverse process (*ta*) where it joined the ilium; the apertures (*v*) for the passage of sacral nerves; and (*b*) portions of thin dense bone adherent to the neural region of the vertebræ numbered 4, 5, and 6.
2. Inferior aspect of the same specimen, showing the rounded underside of the bodies of the vertebræ, their attenuation posteriorly, the sutures (*s*) between the bodies of the vertebræ, the positions (*t*) from which the processes are given off and their divergence backward in the 6th and forward in the 2nd; the positions of the vascular foramina are indicated by the letter *x*.

#### DISCUSSION.

The PRESIDENT agreed with the author in regarding the specimen as indicating the existence of a new genus.



Mary Suft, lith

THEOSPOHYLLIS HOPNERI

Mantain Press map

